

The amount of water retained in cheese is quite independent of the amount of water in the milk from which the cheese is made, since the amount of water that is retained in cheese is dependent upon the conditions of manufacture, and the cheesemaker has it in his power to retain more or less water in the cheese. Therefore we need to consider, in this connection, only the fat and the casein of the milk as the cheese-producing constituents of the milk."

Remembering the importance of casein, as well as fat, in determining the cheese yield of milk with other important facts, viz., that there is no practicable method for making a direct determination of casein in factories, that the fat basis is much the fairer and clearly preferable to that of only weight of milk, that numerous analyses (made chiefly at the Geneva Station) showed about two-thirds of casein for each pound of fat in milk, it appears perfectly clear that the Babcock tester can render valuable service in cheese factories as well as in creameries.

It must not be forgotten, however, that in most instances improvements come gradually. The introduction into cheese factories of the fat basis is a great improvement on the old method of paying for milk. But the method as introduced, while fairer and clearly preferable to the old method, is not so absolutely faultless that it is above criticism.

There appears to me no doubt that the fat basis was a step in the right direction. The question now to be considered is whether a modification of the fat basis should be made; however, such a consideration must not be regarded as an attack upon the fat basis. At this point attention might be called to the fact that during the cheesemaking seasons of 1894 and 1895, while Prof. Dean was conducting his cheese experiments, now familiar to you all, we made in the chemical department a careful and rather extensive study of the relation between butter-fat and casein by exact gravimetric analysis of the milk upon which Prof. Dean experimented in the dairy department. Details of this work have already appeared in the annual reports of 1894 and 1895. The chief facts brought out may be mentioned.

In 1894, for each of the seven months, we found less casein to each pound of fat in the rich than in the medium milk; and, taking Prof. Dean's yields of cheese and our determination of fat, we found also less cheese to each pound of fat in rich than in the medium milk. The averages for the entire season of 1894 are: in 3.243 per cent. milk, 1 pound butter-fat to .66 of a pound of casein, and in 3.890 per cent. milk, 1 pound butter-fat to .59 of a pound of casein. The difference in the yield of cheese to each pound of fat is .24, practically one-quarter of a pound. We found, taking all results, a relative increase of .023 of a pound of casein for each increase in fat of .1 of a pound.

During the following seasons the investigation was continued upon the same line; but the analysis covered a great many more samples of milk. In addition to those taken from our home dairy, samples were also taken from two neighboring cheese factories. The results, in every particular, confirmed those of the previous season. The season's averages gave: in 3.215 per cent. milk, .74 of a pound of casein and 2.783 pounds of cheese, and in 4.093 per cent. milk, .62 of a pound of casein and 2.497 pounds of cheese to each pound of butter-fat. The difference in the yield of cheese to each pound of fat for the second season was .28. We found a relative increase of .021 of a pound of casein for each increase in fat of .1 of a pound. In this connection it may also be mentioned that the relation of fat to casein in the milk of individual cows was studied during the last season. Here also the same fact was borne out, viz., that casein in milk tends to increase when the fat increases and decrease when the fat decreases; and that for every increase or decrease of .1 of a per cent. in fat there is a corresponding increase or decrease in casein of between .02 and .03 of a per cent. Dr. Van Slyke, during the season of 1895, conducted a valuable and extensive investigation, quite similar to this, the results of which I have just given.

Our investigation in the chemical department was chiefly upon the milk of one herd of cows, two samples of milk being secured upon each of three days every week, making six samples a week; while Dr. Van Slyke's investigation was upon the milk of 50 herds, samples being taken once from each herd every alternate week. In these two investigations, made in different years, in two distinctly different places, and quite independently of each other, there is an exceedingly interesting variation of the same experiment.

To what extent do our results and Dr. Van Slyke's agree? Dr. Van Slyke found an increase of .1 per cent. of fat accompanied by an increase of .024 per cent. of casein. We found for the same amount of increase in fat, .023, in 1894, and in 1895, in the milk of the whole herd, .021, and in the milk of individual cows, between .02 and .03. He also found by the same investigation, .25 of a pound of cheese less to one pound of fat in a 4 per cent. milk than in a 3 per cent. milk. We found for the same amount of fat in 1894, .24, and in 1895, .28 of a pound of cheese less from the rich than from the medium milks. There is then an almost exact agreement between these results. Practical dairymen may now ask, what then are your conclusions? My reply is this: the relative quality of the cheese from rich and from medium milk, as compared or estimated by the respective prices they command

in the open markets, must determine whether the milk fat as a basis is sufficiently fair to all who together furnish milk to a cheese factory. Chemical science can determine the relation between fat and casein in milk, between fat in milk and yield of cheese; but it cannot fix prices for which cheese will sell or for which milk can be purchased.

If the quality of cheese thus estimated pronounces the milk-fat basis a little too severe upon the less fortunate patron, then the milk-fat basis may be modified, not displaced; and the modification, if it does come, will undoubtedly be based upon the relation of casein to fat in milk. The addition of 2 to the fat reading does not recognize that casein increases when fat increases, and, therefore, in a 3 per cent milk allows payment for nearly all the casein contained, while in a 5 per cent. milk allows payment for only 74 per cent. of it. If the production of a better quality of milk is to be encouraged, and if the milk-fat basis unmodified is too liberal to the patron who furnishes rich milk to be fair to him who furnishes even medium milk, then the modification should have exactly the opposite effect, viz., to allow payment for all the casein in the rich milk and for only a certain portion of it in the poor milk. It has been advanced in support of the justice of adding 2 to the fat reading of milks of all degrees of richness that the loss of fat and casein in whey increases with increasing richness of milk. But we have found by extensive analyses of whey that there is contained a higher percentage of fat and casein of the total fat and the casein of the milk in the whey from the medium than in the whey from the richer milk. Similar conclusions have been reached in several of the leading American experiment stations.

Cost of Butter Production.

Mr. W. C. Shearer, Oxford Co., Ont., the well-known Jersey breeder, has made a study of the cost of production, and at present is milking some 24 cows which freshened in August and September last. During that period were fed each daily 2 bushels green cut corn with 7 lbs. bran, divided into two feeds; also whatever pasture they could pick; and he is able to report the butter produced at an actual cost of less than 5 cents per pound. Under the winter system of feeding the cost is 11 cents per pound. The winter feed consists of ensilage, pulped mangels, bran, oil cake, and ground grain (oats and peas); ground grain, 5 lbs.; bran, 4 lbs.; oil cake, 2 lbs. per day, mixed with ensilage. The system of feeding the hogs is as follows: Whole mangels at noon; boiled turnips night and morning, mixed with a mixture of ground corn middlings, 1 pint; bran, 1 pint, with skim milk from the separator. In this way he has been able to produce pork for 14 cents per pound on animals under 100 lbs., and over that weight at 23 cents. The pens are well-lighted. Mr. Shearer's dairy is complete in details. Its sanitary arrangement appears perfectly equipped with all modern improvements, the separator and churn being run by tread power. After separation the cream is run through the aerator, twice in winter and four times in summer, and then placed in the cooler. The churning is done twice a week in winter and three times in summer. Taking it all in all, his dairy is now equipped to produce as fine a quality of butter as any establishment of equal capacity in the country, and the products will eventually reach consumers who will appreciate the results of such labor and enterprise, and who will be willing to pay for them what they are worth. Mr. Shearer does not hesitate in stating facts concerning the financial income of his establishment, and says that on his cows he has a monthly income of \$142, on swine \$50.

APIARY.

No. 4.—Spring Management.

BY A. E. HOSHAL, LINCOLN CO., ONT.

No matter how excellent our appliances and correct our system of management, all goes for naught if we have not good strong colonies at the beginning of the honey harvest in June, and to accomplish this is the whole object of spring management. This means that during the spring all our efforts must tend toward the most rapid brooding of our colonies practically possible. To accomplish this the following conditions are necessary: (1) Good prolific queens; (2) good wintering; (3) abundance of stores; (4) warmth; and (5) severely letting alone. The first two of these should always be attended to during the summer and fall previous, and if neglected then they cannot be remedied in the spring. The third should likewise be attended to in the fall. Occasionally, however, a colony will consume an abnormal quantity of honey during the winter, or, perhaps, by oversight may have been missed or neglected in the fall, and so will have to be fed in the spring. There are several ways of doing this, but it will be best done if such colonies be given one or more, according as they need, combs of honey, by removing the empty combs and inserting in their place full ones. If such are not to be had empty combs can be filled with sugar syrup and given them. To fill an empty comb place it on its side in a large bread or other pan. Having the syrup nearly milk warm, with a pitcher or tea pot held from two to three feet above the comb pour it in a stream about the size of a small straw over the surface of the comb until the cells are full; reverse the comb (the syrup will not

drop out of the inverted cells unless shaken or jarred) and in like manner fill the other side. When filled it will be quite mussy, but when given to the bees they clean it up with evident satisfaction. Spring feeding at best, however, is a mistake and the result of accident, mismanagement or neglect. In the fall, when preparing bees for winter, they should then be given sufficient stores to carry them through the spring as well as winter.

Every colony during the spring must have its own heat thoroughly economized and be protected from outside changes of temperature as far as possible. To do this contract all entrances to about $\frac{3}{4}$ to $\frac{1}{2}$ of an inch and shut off all ventilation except the entrance, especially seeing that all hives are snug and tight around the top. Colonies that are very weak will be placed at an advantage and helped much if their hives be contracted so that they are able to cover all their combs. Protect all colonies with an outer case and packing if such are to be had so that they will not be effected by outside temperature. Colonies wintered outside will, of course, be already packed. With colonies wintered inside all these matters should be attended to as soon as they are placed on their summer stands, had a cleansing flight, and quieted down; and those wintered outside, as early as weather will permit.

Everything that a colony requires to have done should be accomplished with but once opening it, and the necessity of even this must always be considered as only the result of an accident or mismanagement. Attend rather to all these internal matters of the colony in the fall. In an apiary that is properly managed all that is necessary to be done in early spring is, with colonies wintered outside, to stop ventilation and contract their entrances, and with those wintered inside to place them on their summer stands, stop ventilation, contract their entrances, and where practicable protect with packing; further than this leave all severely alone until they begin to crowd their winter quarters and require more room.

Do not attempt to stimulate brooding through feeding, uncapping honey about the brood, spreading brood, etc. Such operations, if successful at all, are only so in the hands of the most expert; I doubt if they are even then, and at best they are not producing honey with the least expense of time and labor.

The time for setting bees out which have been wintered inside depends on circumstances. If they are to be thoroughly protected with packing all about them, then the first fine day after the 15th or 20th of March when they can fly is none too soon, but if not thus protected I would rather leave them in the cellar until the middle of April or about the time the early willows and soft maples come into bloom. However, should they show signs of wintering badly by soiling their hives, becoming restless and flying out much in their winter repository, they had then best be set out on the first fine day, given a cleansing flight, and then returned to their winter repository again. In such a case when they are set out permanently the second time be careful to place each colony in the same place it occupied on the first occasion.

About the middle of fruit bloom to the first of June, when they are beginning to crowd their winter quarters, the packing will have to be removed and the hive expanded according to the needs of each colony. Those that have wintered in contracted brood chambers will now have to have them expanded to their full capacity, while those occupying full-sized ones and are crowding them will require to be given a surplus case. In expanding the brood chamber of a Langstroth hive never place the combs that are added between the brood, but always next the side of the brood chamber. Bees sometimes swarm in May for want of room; this should never be allowed to occur. Those who brag of their early swarms, especially in May, proclaim their ignorance rather than their success.

Colonies carelessly opened and disturbed in the spring before fruit bloom not infrequently ball and kill their queen. If you are anxious to watch the development of your colonies, to learn their manner of working, habits, etc., select one or more for this purpose, and do not be constantly mauling and disturbing all you have, especially about their brood nest.

To determine if a colony has sufficient stores do not open it, but heft it, and if suspiciously light weigh it.

Colonies that are not packed about the top should never have their covers removed if it can be avoided. They will not be sealed down tightly again and so will allow much heat to escape.

Do not unite weak colonies in the spring unless queenless, nor give them brood from strong colonies to build them up. Do the best you can with each upon its own resources, then if desirable unite just before the honey flow in June.

Robbing started in early spring will in all probability prove disastrous to some colonies. Keep all entrances well contracted, covers tight, and use extreme care should any hives have to be opened. It is an advantage for colonies to stand in the sun during the spring, but they should be shaded during the heat of summer. These varying conditions can be obtained by means of a shade board.

As the spring is now here many no doubt have decided to try this to give bee-keeping a trial, and are now considering the purchasing of bees. As to how much one should pay for them I leave each to decide, but I wish to draw attention to a serious and sometimes fatal mistake that is often made at

this very decide upon which you use the making a handicapped start into are domic are after bees in the them and have him 'round be especially too much Italian q introduce Italianize experience not posse the native builders a nicer and

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